

**Exhibit A-1**

**EXHIBIT A-25**

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**Typed Drawing**

<b>Word Mark</b>	FACET
<b>Goods and Services</b>	(CANCELLED) IC 001. US 006. G & S: Synthetic Resins for Use as Adsorbents for the Removal of Contaminents from Waste Water. FIRST USE: 19760130. FIRST USE IN COMMERCE: 19760130
	IC 007. US 023. G & S: Filters and Separators for Liquids, Solids, and Gasses, for Use as Parts of Machines, Engines, or Motors; Carburetors and Parts Therefor; Electromagnetic Clutches; Fuel Pumps. FIRST USE: 19750522. FIRST USE IN COMMERCE: 19750522
	IC 009. US 026. G & S: Monitors for Pollution Control Equipment. FIRST USE: 19751005. FIRST USE IN COMMERCE: 19751005
	IC 011. US 031. G & S: Pollution Control Equipment and Systems-Namely, Filtration and Separation Equipment for Liquids, Solids and Gases; Filtration and Separation Equipment for Liquids, Solids, and Gases, for Use Other than as Parts of Machines, Engines, or Motors. FIRST USE: 19751005. FIRST USE IN COMMERCE: 19751005
	IC 012. US 023 031. G & S: Starter Drives for Land Vehicles; Clutches; Filters for Land Vehicles. FIRST USE: 19750818. FIRST USE IN COMMERCE: 19750818
	(CANCELLED) IC 042. US 100. G & S: Engineering Consulting Services in Connection with Pollution Control. FIRST USE: 19760130. FIRST USE IN COMMERCE: 19760130
<b>Mark Drawing Code</b>	(1) TYPED DRAWING

## Trademark Electronic Search System (TESS)

Page 2 of 2

**Serial Number** 73142559  
**Filing Date** September 26, 1977  
**Current Filing Basis** 1A  
**Original Filing Basis** 1A  
**Published for Opposition** August 21, 1979  
**Change In Registration** CHANGE IN REGISTRATION HAS OCCURRED  
**Registration Number** 1148543  
**Registration Date** March 24, 1981  
**Owner** (REGISTRANT) Facet Enterprises, Inc. CORPORATION DELAWARE Suite 800  
7030 S. Yale Ave. Tulsa OKLAHOMA 74136  
  
 (LAST LISTED OWNER) CLARCOR FILTRATION PRODUCTS, INC.  
CORPORATION DELAWARE 840 CRESCENT CENTRE DR. SUITE 600  
FRANKLIN TENNESSEE 37067  
**Assignment Recorded** ASSIGNMENT RECORDED  
**Attorney of Record** ANDREW J. HEINISCH  
**Type of Mark** TRADEMARK. SERVICE MARK  
**Register** PRINCIPAL  
**Affidavit Text** SECT 15. PARTIAL SECT 8 (6-YR). SECTION 8(10-YR) 20010829.  
**Renewal** 1ST RENEWAL 20010829  
**Live/Dead Indicator** LIVE

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**Exhibit A-2**

**EXHIBIT A-28**

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**Goods and Services**

(CANCELLED) IC 001. US 006. G & S: Synthetic Resins for Use as Adsorbents for the Removal of Contaminents from Waste Water. FIRST USE: 19750818. FIRST USE IN COMMERCE: 19750818

IC 003. US 052. G & S: Cleaning Preparations for Use on Mechanical Parts. FIRST USE: 19750818. FIRST USE IN COMMERCE: 19750818

(CANCELLED) IC 004. US 015. G & S: Starting Fluid for Automotive Engines. FIRST USE: 19750818. FIRST USE IN COMMERCE: 19750818

IC 007. US 023. G & S: Filters and Separators for Liquids, Solids, and Gases, for Use as Parts of Machines, Engines, or Motors; Carburetors and Parts Therefor; Engine Ignition Systems and Parts Therefor; Engine and Carburetor Tune-Up Kits and Parts; Electro-Magnetic Clutches; Fuel Pumps. FIRST USE: 19750522. FIRST USE IN COMMERCE: 19750522

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IC 011. US 031. G & S: Air and Water Pollution Filters and Separators and Parts Therefor; Filters and Separators for Liquids, Solids and Gases, All of the Forgoing for Use Other than as Parts of Machines, Engines or Motors. FIRST USE:

19751005. FIRST USE IN COMMERCE: 19751005

IC 012. US 019. G &amp; S: Starter Drives for Land Vehicles; Clutches; Filters for Land Vehicles. FIRST USE: 19750818. FIRST USE IN COMMERCE: 19750818

(CANCELLED) IC 042. US 106. G &amp; S: Engineering Consulting Services in Connection with Pollution Control. FIRST USE: 19760130. FIRST USE IN COMMERCE: 19760130

**Mark Drawing Code** (2) DESIGN ONLY**Design Search Code** 26.13.13 - Quadrilateral (two quadrilaterals); Two quadrilaterals  
26.13.21 - Quadrilaterals that are completely or partially shaded  
26.15.13 - More than one polygon  
26.15.21 - Polygons that are completely or partially shaded  
26.17.10 - Lines, zig-zag; Zig-zag line(s)  
26.17.12 - Angles (geometric); Chevrons  
26.17.25 - Other lines, bands or bars**Serial Number** 73142539**Filing Date** September 26, 1977**Current Filing Basis** 1A**Original Filing Basis** 1A**Published for Opposition** June 2, 1981**Change In Registration** CHANGE IN REGISTRATION HAS OCCURRED**Registration Number** 1165986**Registration Date** August 25, 1981**Owner** (REGISTRANT) Facet Enterprises, Inc. CORPORATION DELAWARE Suite 800  
7030 S. Yale Ave. Tulsa OKLAHOMA 74136(LAST LISTED OWNER) PUROLATOR FACET, INC. CORPORATION BY  
MERGER, BY ASSIGNMENT, BY ASSIGNMENT, BY CHANGE OF NAME, BY  
CHANGE OF NAME DELAWARE 8439 TRIAD DRIVE GREENSBORO NORTH  
CAROLINA 27409**Assignment Recorded** ASSIGNMENT RECORDED**Attorney of Record** ANDREW J HEINISCH**Type of Mark** TRADEMARK SERVICE MARK**Register** PRINCIPAL**Affidavit Text** SECT 15. PARTIAL SECT 8 (6-YR). SECTION 8(10-YR) 20011127.**Renewal** 1ST RENEWAL 20011127**Live/Dead Indicator** LIVE

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Page 3 of 3

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3/18/2011

EXHIBIT A-31

**Exhibit B**

**EXHIBIT A-32**

Int. Cl: 7

Prior U.S. Cls.: 13, 19, 21, 23, 31, 34, and 35

Reg. No. 3,486,479

United States Patent and Trademark Office

Registered Aug. 12, 2008

TRADEMARK  
PRINCIPAL REGISTER

REACTIV

POSITORK DISTRIBUTING, INC. (DELAWARE  
CORPORATION)  
SUITE 2211  
4850 TASSAJARA ROAD  
DUBLIN, CA 94568

FOR: ALTERNATORS FOR LAND VEHICLES  
AND COMPONENTS THEREOF, NAMELY, BRU-  
SHES, PULLEYS, ENGINE BEARINGS, DISTRIBU-  
TOR ROTORS AND STATORS, IN CLASS 7 (U.S.  
CLS. 13, 19, 21, 23, 31, 34 AND 35).

FIRST USE 10-1-2006; IN COMMERCE 10-1-2006.

THE MARK CONSISTS OF STANDARD CHAR-  
ACTERS WITHOUT CLAIM TO ANY PARTICULAR  
FONT, STYLE, SIZE, OR COLOR.

SN 78-929,937, FILED 7-14-2006.

SHANNON TWOHIG, EXAMINING ATTORNEY



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# REACTIV

<b>Word Mark</b>	REACTIV
<b>Goods and Services</b>	IC 007. US 013 019 021 023 031 034 035. G & S: Alternators for land vehicles and components thereof, namely, brushes, pulleys, engine bearings, distributor rotors and stators. FIRST USE: 20061001. FIRST USE IN COMMERCE: 20061001
<b>Standard Characters Claimed</b>	
<b>Mark Drawing Code</b>	(4) STANDARD CHARACTER MARK
<b>Serial Number</b>	78929937
<b>Filing Date</b>	July 14, 2006
<b>Current Filing Basis</b>	1A
<b>Original Filing Basis</b>	1B
<b>Published for</b>	October 16, 2007

Trademark Electronic Search System (TESS)

Page 2 of 2

**Opposition**

Registration Number 3486479

Registration Date August 12, 2008

Owner (REGISTRANT) POSITORK DISTRIBUTING, INC. CORPORATION DELAWARE  
Suite 2211 4850 Tassajara Road Dublin CALIFORNIA 94568

Attorney of Record Elliott J. Stein,

Type of Mark TRADEMARK

Register PRINCIPAL

Live/Dead Indicator LIVE

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Exhibit C-1

EXHIBIT A-36

## Certificate of Registration



This Certificate issued under the seal of the Copyright Office in accordance with title 17, *United States Code*, attests that registration has been made for the work identified below. The information on this certificate has been made a part of the Copyright Office records.

*Maria A. Pallante*

Register of Copyrights, United States of America

Registration Number

VA 1-784-168

Effective date of registration:

July 29, 2011

**Title**

Title of Work: Facet Reactiv Brochure

**Completion/Publication**

Year of Completion: 2009

Date of 1st Publication: September 30, 2009      Nation of 1st Publication: United States

**Author**

Author: Positork Distributing, Inc.

Author Created: text, photograph(s), 2-D artwork

Work made for hire: Yes

Citizen of: United States

Domiciled in: United States

**Copyright claimant**

Copyright Claimant: Positork Distributing, Inc.

4900 Hopyard Road, Suite 100, Pleasanton, CA, 94688, United States

**Certification**

Name: Elliott J. Stein

Date: July 29, 2011

Applicant's Tracking Number: 050265-00002

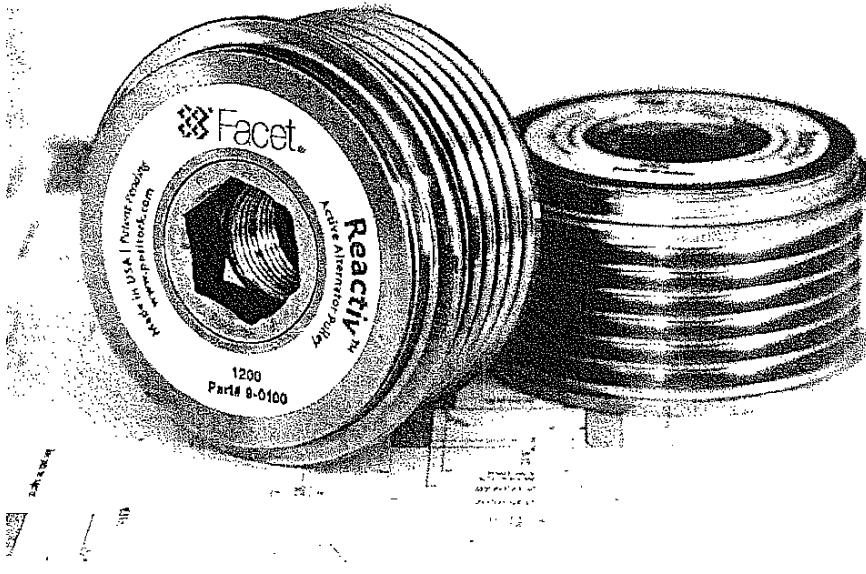
**Exhibit C-2**

**EXHIBIT A-38**

# Facet Reactiv™

MADE IN U.S.A.

Combines the Best  
Features of Solid, Clutch,  
and Decoupler Pulleys,  
and Replaces Them All.



More and more vehicles are rolling off the assembly line equipped with clutch and decoupler pulleys threaded on their alternators. There's a good reason for that.

Today's generation of high-output alternators place tremendous stress on the entire accessory drive system. Those alternators are also being mated to growing numbers of rough-idling, four-cylinder and diesel engines that exert even greater belt-speed changes on the entire system. And if that weren't enough, car companies are decreasing engine idle speeds in order to increase fuel economy, which just adds more vibration and belt speed fluctuations to the mix.

The end result? A whole lot of screeching, stretching, slipping and broken belts, dead batteries, and water pump and power-steering bearings that break down much too soon.

Clutch, and particularly decoupler pulleys, go a long way to calming those vibrating tensioners and reducing drive belt wear and tear... but we've gone one better.

The Reactiv™ pulley is a patent pending system that provides the same benefits as both clutch and decoupler pulleys in a much simpler and more reliable design.

What's more, the Reactiv™ Pulley is the **only product on the market you can use as a direct swap and replacement for both clutch and decoupler pulleys.**



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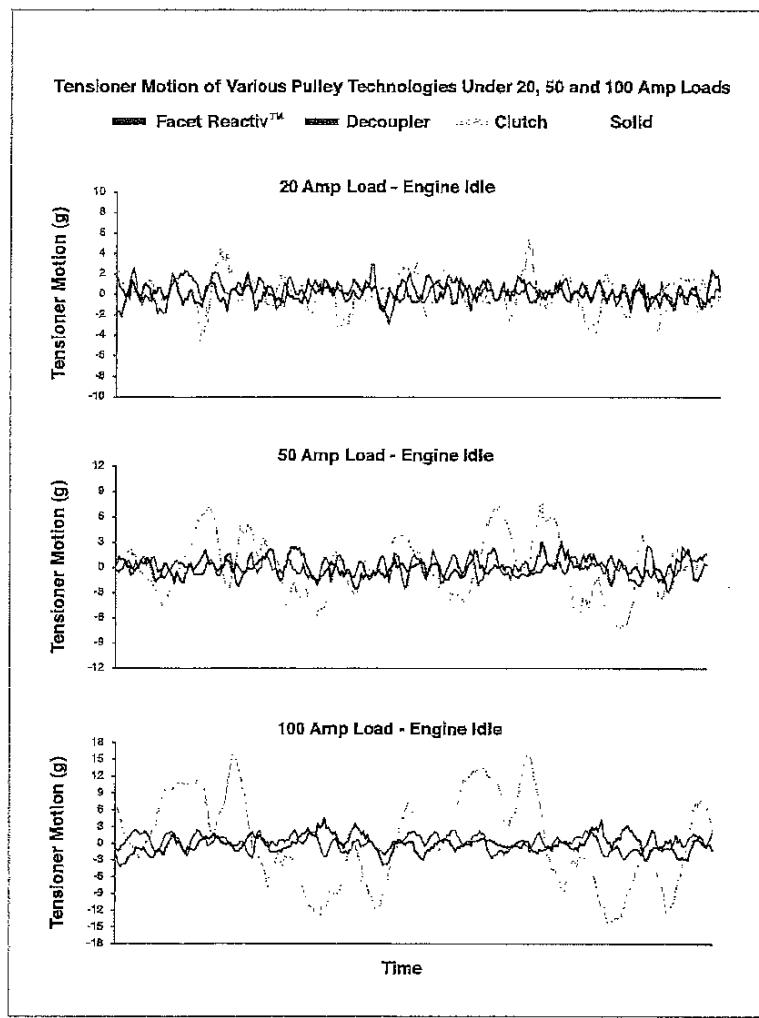
We've Made  
Innovative Auto Parts  
for Close to a Century

At Facet®, we've been making  
rotating electrical parts  
better, stronger and more  
reliable for nearly 100 years.

The Bendix starter drive,  
Folo-Thru™ inertia drives, and  
Positork™ drives are just a few  
of our creations. Now, we're  
proud to add Reactiv™ to that  
list of innovations.

---

## Fail-Safe and Quiet, the Reactiv™ Pulley Provides the Same Belt-calming Benefits as a Decoupler Pulley



Clutch and decoupler pulleys overrun or "freewheel" when the engine decelerates; this reduces strain on the drive belt. The downside is that this uncontrolled freewheeling also sends needle bearings in a clutch pulley spinning to extreme RPMs. The result? Excessive friction, heat and premature failure of rollers and springs.

### The Reactiv™ Pulley Features Controlled Overrun™

Our research and testing prove that one can quiet belt-chirps and cancel out damaging speed fluctuations between the drive belt and alternator with a precise degree of overrun. In essence, the Reactiv™ pulley features just the right amount of overrun—enough to stop vibrations and reduce belt wear, but not enough to cause the worn bearings and springs you see in conventional clutch and decoupler pulleys.

*Left: Extensive testing proves that the Reactiv™ pulley provides the same belt-calming benefits as a decoupler pulley in a simpler more reliable design.*

## Controlled Overrun™ Makes Reactiv™ More Durable

## The Competition has a Weak Link— Clutch Pulleys Simply Aren't Durable Enough

Clutch pulleys do not accommodate abrupt increases in speed, as when combustion occurs, since they engage suddenly and attempt to accelerate the shaft rotation rapidly to match the increased belt velocity from each piston-firing event. Such repeated sudden engagement of the clutch with the pulley results in tensioner bounce, noise, high wear, and frequent failures, not only of the clutch itself, but also of the load surges on the FEAD (Front Engine Accessory Drive) component bearings and stretching serpentine belts.

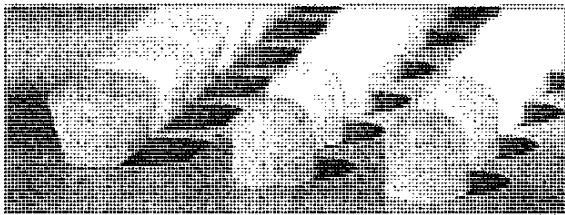
The clutch mechanism in a starter drive, which is essentially what you find inside clutch pulleys, is designed to crank an engine for less than 5 seconds, then overrun freely for about another 5 seconds, then cool off for at least 20 seconds before the cycle re-starts. Even OE-caliber drive clutches are only expected to withstand this cycle about 50,000 times before failing.

Yet an alternator clutch pulley locks and releases 3 times per engine revolution at idle, or about 144,000 times per hour...with no rest period. When you compare these simple numbers, it becomes painfully obvious why clutch pulleys don't last.

### We Offer the Benefits of a Decoupler, with Far Greater Reliability

When they were introduced to the market, decoupler pulleys were a big step forward—they used a spring and friction-clutch mechanism to attenuate engine excitation frequencies. This system isolates the alternator from the drive belt and significantly reduces noise, vibration and wear.

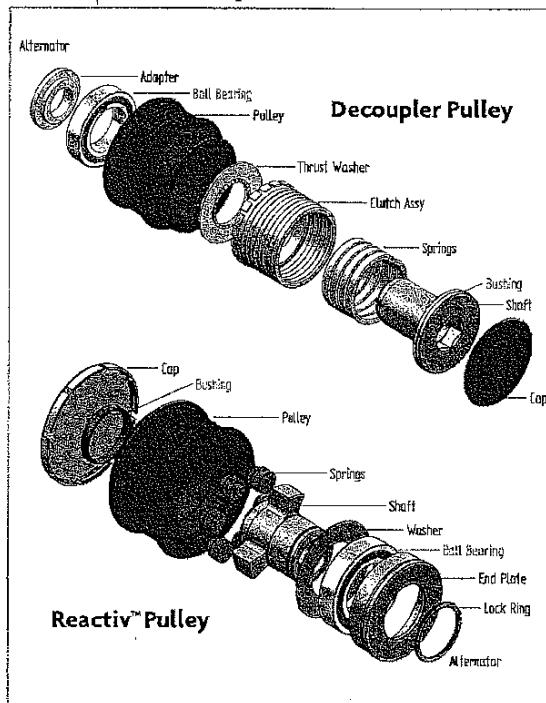
In short, it was a good mouse trap, but we've made a better,



*Reactiv™ springs are pulse-tuned for specific applications and engineered for extreme durability.*

more reliable one. It starts with our proprietary spring system.

Conventional decouplers use a friction clutch and a steel coil spring, which have a tendency to fail from invisible fatigue cracks, corrosion, and heat stresses due to grease loss. We achieve the same belt and tensioner calming effects by using a simpler, proprietary and custom-formulated, high-temperature material spring. Reactiv™ springs never deform and can withstand continuous 130°C under hood temperatures with no lubrication and no loss in performance whatsoever.



*Simplicity is the key to Reactiv's™ durability.*

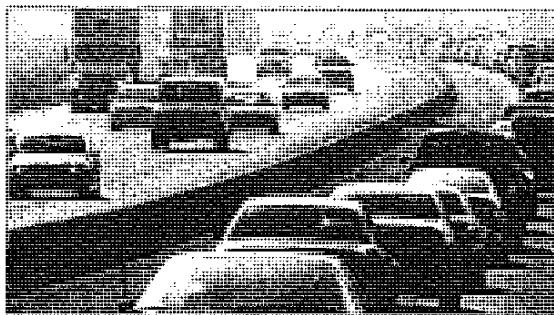
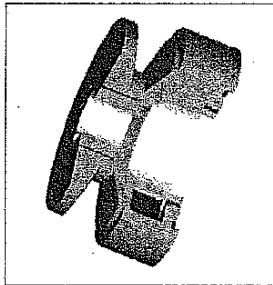
The Reactiv™ springs and the alternator rotor comprise a spring - mass system which does have a resonant frequency. Yet, like decouplers, we designed our springs so that their resonant frequency is less than engine idle speed. So, in operation, the Reactiv™ pulley passes momentarily through resonance during the first partial revolution of the engine while it is being started, but never while the engine is running.

### Reactiv™ is Incredibly Versatile

Like decouplers, our springs are tuned for four, six and eight-cylinder applications and are, in a word, bullet proof.

Should the bearing in a Reactiv™ pulley actually fail, the pulley will still continue to transfer full torque so the alternator will charge the battery. No other product on the market can do the same. And when it comes time to eventually rebuild an alternator with a Reactiv™ pulley, servicing our pulley is as quick and simple as pressing out the end cap and replacing the springs. The Reactiv™ pulley is, hands-down, the easiest product of its kind to work with.

The Reactiv™ design is so effective and flexible that it can also be incorporated into V-Belt pulleys. No other active pulley design can do this. Imagine, an effective solution to your customer's impossible to resolve V-Belt breakage issues... that is a simple drop-in fit into their current alternator?



### Reactiv™ is Proven Under Brutal Conditions

In developing Reactiv™ we certainly undertook lots of lab testing. In fact, we developed custom test benches that accumulated over a million cycles as they ran 24/7 for months under repeated testing. But we know that bench testing is one thing; real world testing is something else entirely... which is why we've outfitted a large cab company, the same one that does OE fleet testing for one of the Big 3, with Reactiv™ pulleys.

You couldn't dream up a more brutal testing ground. Constant stop and go traffic and pedal-to-metal gear shifts place extreme stress on drive belts and alternator pulleys. We've racked up tens of thousands of miles under these conditions without a single failure.

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[www.positork.com](http://www.positork.com)

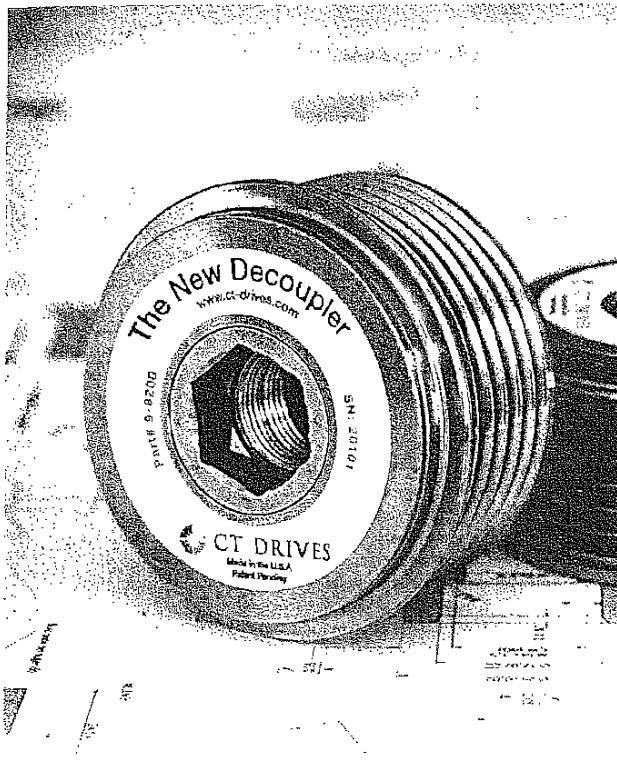
Copyright © 2009. All rights reserved. Positork Distributing, Inc.

Reactiv™ Proof that Simpler is Better

 Facet.

## Exhibit D

EXHIBIT A-43



# CT Drives™

MADE IN THE U.S.A.

Combines the Best  
Features of Solid, Clutch  
and Decoupler Pulleys,  
and Replaces Them All.



## CT DRIVES

More and more vehicles are rolling off the assembly line equipped with clutch and decoupler pulleys threaded on their alternators. There's a good reason for that.

Today's generation of high-output alternators are also being mated to growing numbers of rough-idling, four-cylinder and diesel engines that exert even greater belt-speed changes on the entire system. And if that weren't enough, car companies are decreasing engine idle speeds in order to increase fuel economy, which just adds more vibration and belt speed fluctuations to the mix.

The end result? A whole lot of screeching, stretching, slipping and broken belts, dead batteries, and water pump and power-steering bearings that break down much too soon.

Clutch, and particularly decoupler pulleys, go a long way to calming those vibrating tensioners and reducing drive belt wear and tear... but we've gone one better.

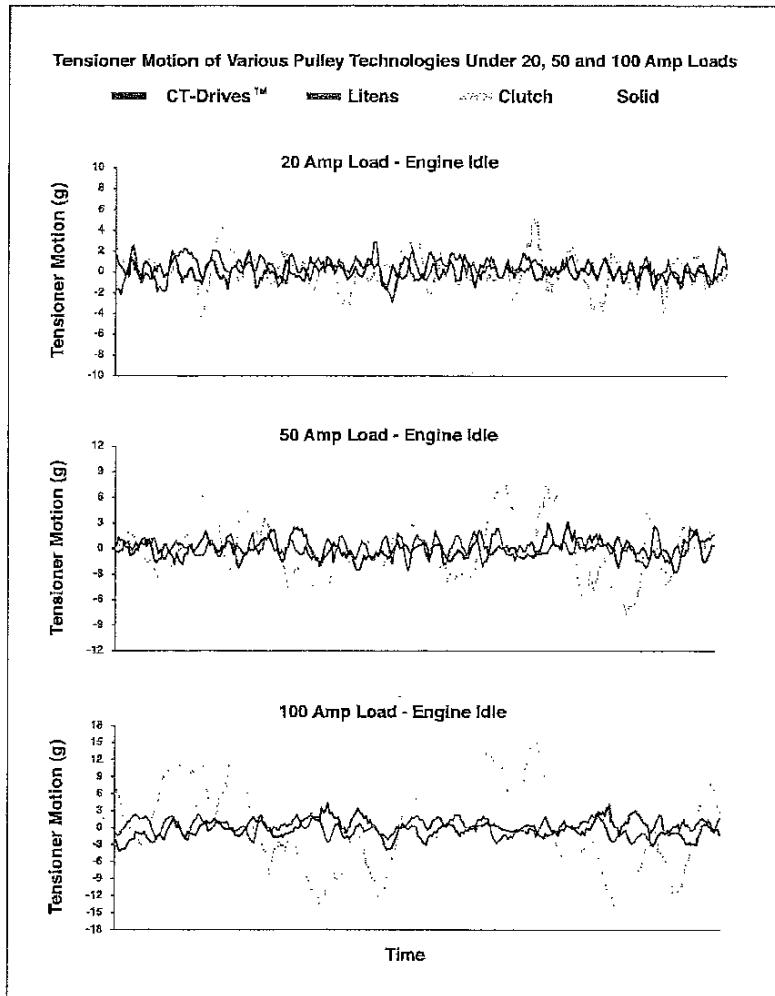
The CT Drives pulley is a patent pending system that provides the same benefits as both clutch and decoupler pulleys in a much simpler and more reliable design.

What's more, the CT Drives pulley is the only product on the market you can use as a direct swap and placement for both clutch and decoupler pulleys.

We've Developed Innovative  
Auto Parts for Close to a  
Quarter Century.

At Epilogics/CT Drives we've been inventing and commercializing innovative new products for the automotive industry for nearly twenty-five years. The Mechanical Diode® One Way Clutch, the Kühl Wheel®, and the Infinitely Variable Transmission are just a few of our most successful creations. Now we're proud to add The New Decoupler alternator pulley to our list of innovations.

## Fail-Safe and Quiet, the CT Drives Pulley Provides the Same Belt-Calming Benefits as a Decoupler Pulley



Clutch and decoupler pulleys overrun or "freewheel" when the engine decelerates; this reduces strain on the drive belt. The downside is that this uncontrolled freewheeling also sends needle bearings in a clutch pulley spinning to extreme RPMs. The result? Excessive friction, heat and premature failure of rollers and springs.

### The CT Drives Pulley Features Secure Overrun

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*Left: Extensive testing proves that the CT Drives pulley provides the same belt-calming benefits as a decoupler pulley in a simpler more reliable design.*

## Secure Overrun Makes CT Drives More Durable

## The Competition has a Weak Link— Clutch Pulleys Simply Aren't Durable Enough

Clutch pulleys do not accommodate abrupt increases in speed, as when combustion occurs, since they engage suddenly and attempt to accelerate the shaft rotation rapidly to match the increased belt velocity from each piston-firing event. Such repeated sudden engagement of the clutch with the pulley results in tensioner bounce, noise, high wear, and frequent failures, not only of the clutch itself, but also of the load surges on the FEAD (Front Engine Accessory Drive) component bearings and stretching serpentine belts.

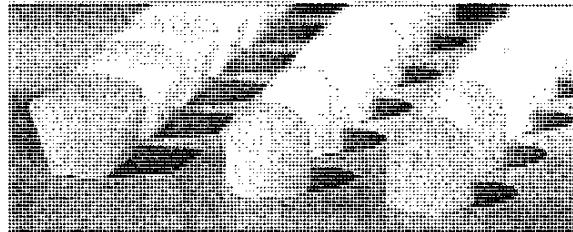
The clutch mechanism in a starter drive, which is essentially what you find inside clutch pulleys, is designed to crank an engine for less than 5 seconds, then overrun freely for about another 5 seconds, then cool off for at least 20 seconds before the cycle re-starts. Even OE-caliber drive clutches are only expected to withstand this cycle about 50,000 times before failing.

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### We Offer the Benefits of a Decoupler, with Far Greater Reliability

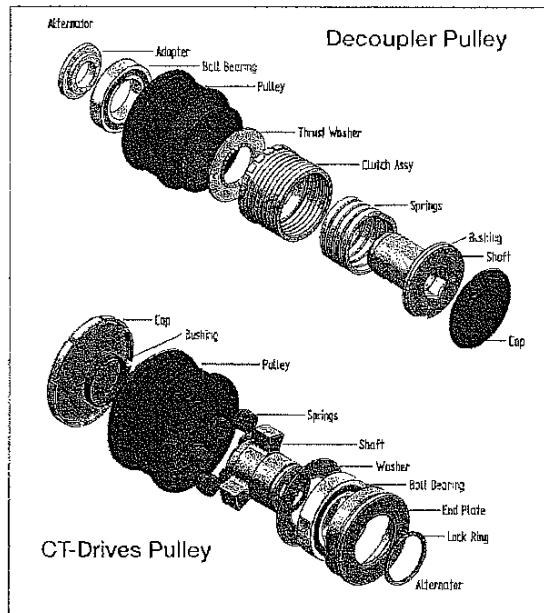
When they were introduced to the market, decoupler pulleys were a big step forward—they used a spring and friction-clutch mechanism to attenuate engine excitation frequencies. This system isolates the alternator from the drive belt and significantly reduces noise, vibration and wear.

In short, it was a good mouse trap, but we've made a better, more reliable one. It starts with our proprietary spring system



*CT Drives springs are pulse-tuned for specific applications and engineered for extreme durability.*

Conventional decouplers use a friction clutch and a steel coil spring, which have a tendency to failure from invisible fatigue cracks, corrosion, and heat stresses due to grease loss. We achieve the same belt and tensioner calming effects by using a simpler, proprietary and custom-formulated, high-temperature material spring. CT Drives springs never deform and can withstand continuous 130°C under hood temperatures with no lubrication and no loss in performance whatsoever.



*Simplicity is the key to CT Drives' durability.*

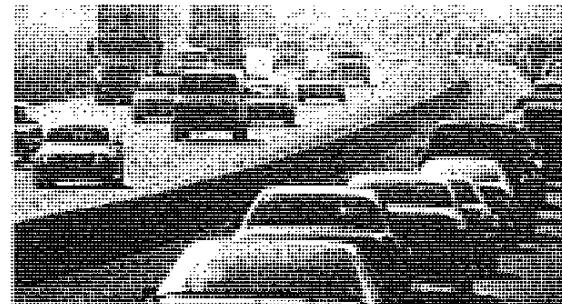
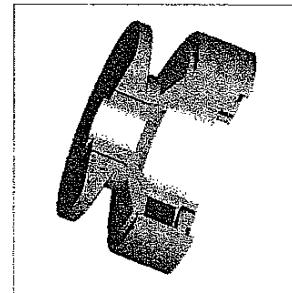
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The CT Drives design is so effective and flexible that it can also be incorporated into V-Belt pulleys. No other active pulley design can do this. Imagine, an effective solution to your customer's impossible to resolve V-Belt breakage issues...that is a simple drop-in fit into their current alternator?



### CT Drives is Proven Under Brutal Conditions

In developing CT Drives we certainly undertook lots of lab testing. In fact, we developed custom test benches that accumulated over a million cycles as they ran 24/7 for months under repeated testing. But we know that bench testing is one thing; real world testing is something else entirely...which is why we've outfitted a large cab company, the same one that does OE fleet testing for one of the Big 3, with CT Drives pulleys.

You couldn't dream up a more brutal testing ground. Constant stop and go traffic and pedal-to-metal gear shifts place extreme stress on drive belts and alternator pulleys. We've racked over one hundred thousand of miles under these conditions without a single failure.



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**Exhibit E**

**EXHIBIT A-48**

# CT DRIVES



## Company Overview

### Technology

### Products

### Features & Benefits

### Part Number

### Collectus

CT Drives The New Decoupler  
Facet Reactiv Pulley  
Lighter... Stronger... Cheaper... GUARANTEED!

CT Drives was formed to commercialize a proprietary, patent-pending technology that replaces both overrunning clutch & decoupler type pulleys found in modern automobiles. This elegantly simple design results in a product that is not only functionally superior but is lighter, cheaper and more robust than either alternative.

This proprietary product is sold into the aftermarket under the CT Drives brand name and can be designed to meet all OE requirements at a substantial cost savings.

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# CT DRIVES



## Company Overview

### Technology >

Today's generation of high-output alternators place tremendous stress on the entire accessory drive system.

#### Products

##### Features & Benefits >

##### Purchasing

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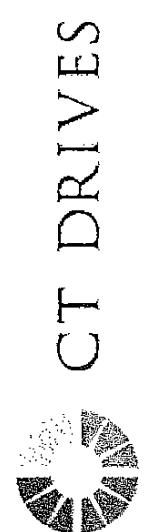
Those alternators are also being mated to growing numbers of rough-idling, four cylinder and diesel engines that exert even greater belt-speed changes on the entire system. And if that weren't enough, car companies are decreasing engine idle speeds in order to increase fuel economy, which just adds more vibration and belt speed fluctuation to the mix.

The end result? A whole lot of screeching, scratching and broken belts, dead batteries and water pump and power steering bearings that break down much too soon.

Clutch, particularly decoupler pulleys, go a long way to calming those vibrations and reducing drive belt and tear... but we've gone one better.

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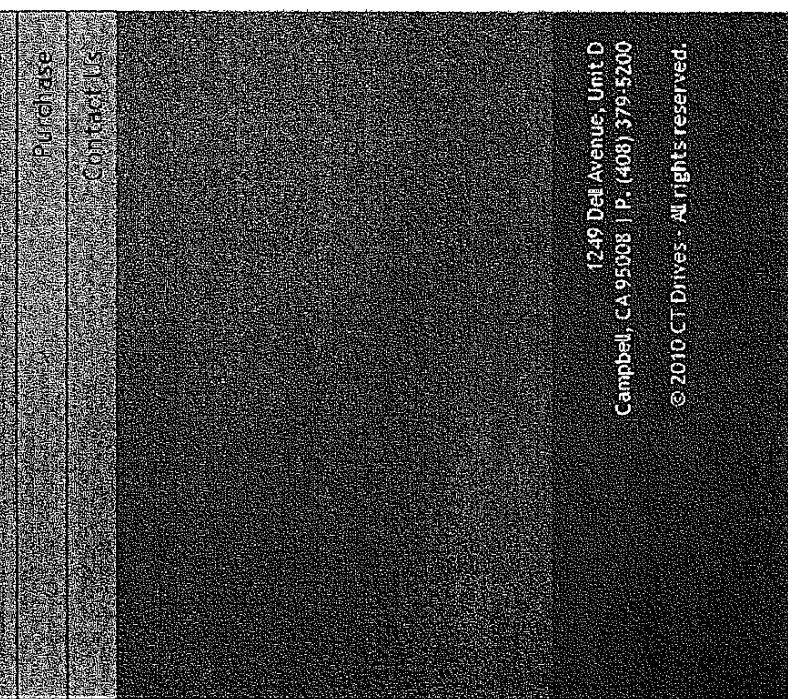
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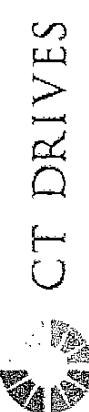
## Alternator Pulley Comparison

The below presentation demonstrates the key features and benefits of CT Drives isolating decoupler pulley (CTD IDP):

- Replaces All Pulleys in Fit and Function
- Fail-Safe Durability
- Tensioner-Calming Isolation
- Belt-Chirp Quieting



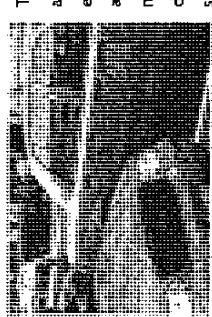
## EXHIBIT A-51



## CT Drives Combines the Best Features of Solid, Clutch, and Decoupler Pulleys, and Replaces Them All.

More and more vehicles are ruling off the assembly line equipped with clutch and decoupler pulleys threaded on their alternators. There's a good reason for that.

### Products



#### Today's generation of high-output

alternators place tremendous stress on the entire accessory drive system. Those alternators are also being mated to growing numbers of rough-idling, four-cylinder and diesel engines that exert even greater belt-speed changes on the entire system. And if that weren't enough, car companies are decreasing engine idle speeds in order to increase fuel economy, which just adds more vibration and belt speed fluctuations to the mix. The end result? A whole lot of screeching, stretching, slipping and broken belts, dead batteries, and water pump and power-steering bearings that break down much too soon. Clutch, and particularly decoupler pulleys, go a long way to claiming those vibrating tensioners and reducing drive belt wear and tear... but we've gone one better.



The CT Drives pulley is a patent pending system that provides the same benefits as both clutch and decoupler pulleys in a much simpler and more reliable design.

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*What's more, the CT Drives Pulley is the only product on the market you can use as a direct swap and replacement for both clutch and decoupler pulleys.*

Done

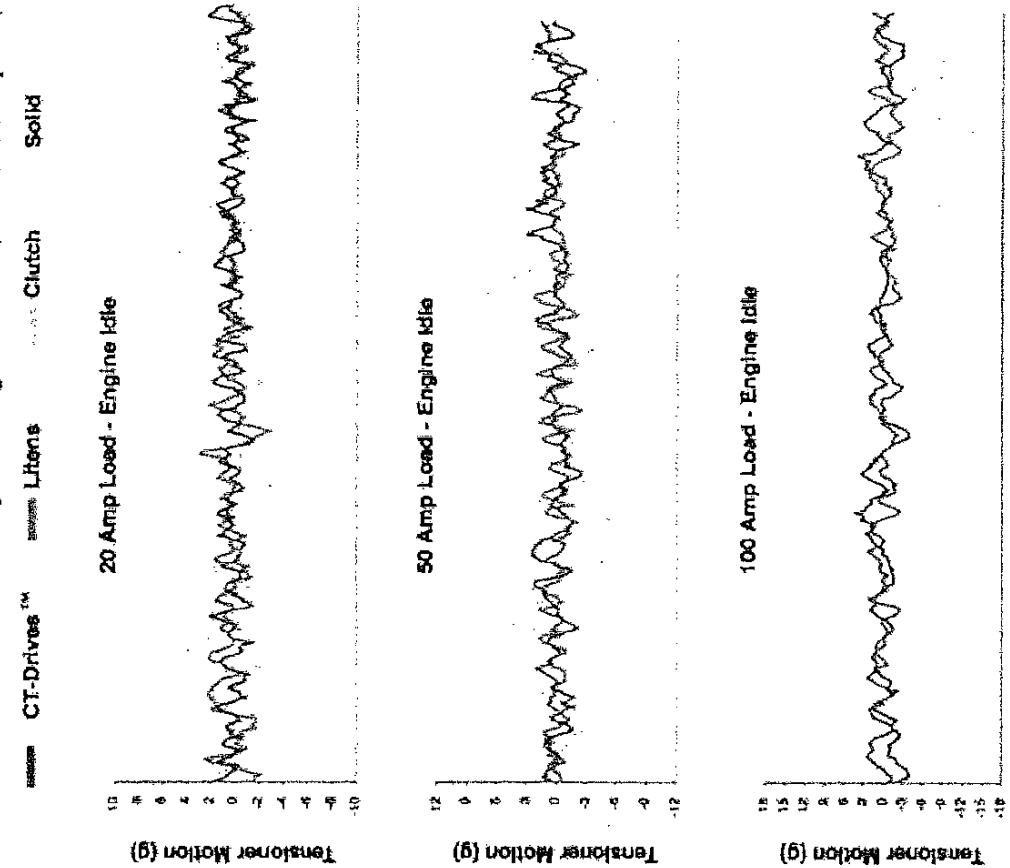
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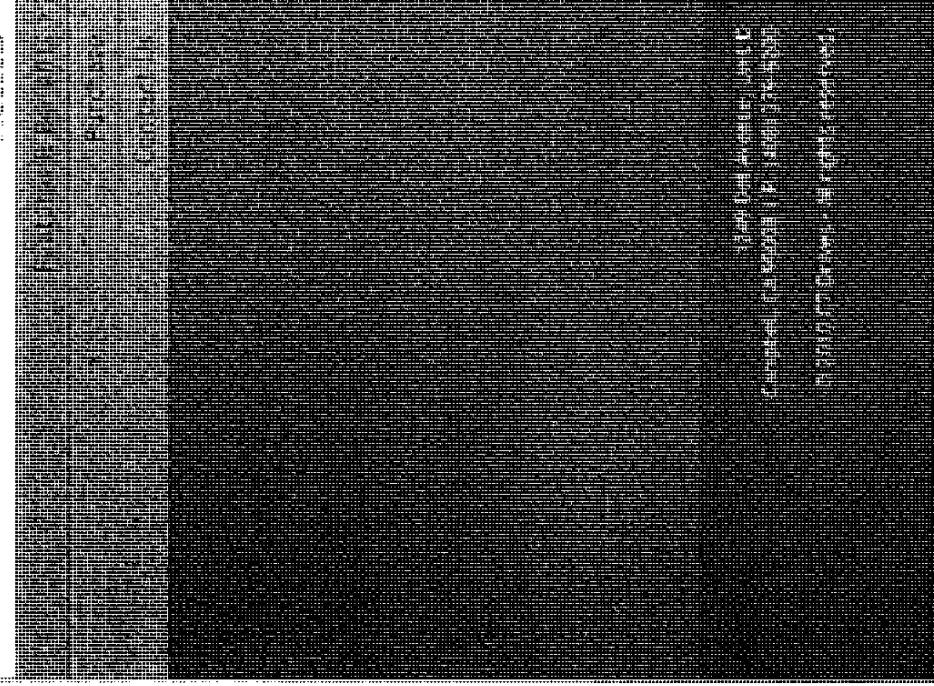
## Fail-Safe and Quiet, the CT Drives Pulley Provides the Same Belt-calming Benefits as a Decoupler Pulley

Clutch and decoupler pulleys overrun or "freewheel" when the engine decelerates; this reduces strain on the drive belt. The downside is that this uncontrolled freewheeling also sends needle bearings in a clutch pulley spinning to extreme RPMs. The result? Excessive friction, heat and premature failure of rollers and springs.

**Tensioner Motion of Various Pulley Technologies Under 20, 50 and 100 Amp Loads**



Products



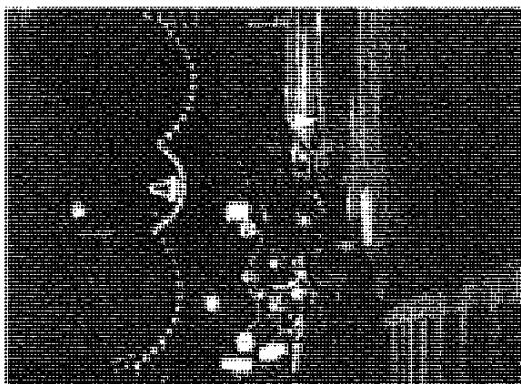
**Above:** Extensive testing proves that the CT Drives pulley provides the same belt-coupling benefits as a decoupler pulley in a simpler more reliable design.

## The CT Drives Pulley Features Secure Overrun

Our research and testing prove that one can quiet belt-chirps and cancel out damaging speed fluctuations between the drive belt and alternator with a precise degree of overrun. In essence, the CT Drives pulley features just the right amount of overrun—enough to stop vibrations and reduce belt wear, but not enough to cause the worn bearings and springs you see in conventional clutch and decoupler pulleys.

The Competition has a Weak Link- Clutch Pulleys Simply Aren't Durable Enough

Clutch pulleys do not accommodate abrupt increases in speed, as when combustion occurs, since they engage suddenly and attempt to accelerate the shaft rotation rapidly to match the increased belt velocity from each piston-firing event. Such repeated sudden engagement of the clutch with the pulley results in tensioner bounce, noise, high wear, and frequent failures, not only of the clutch itself, but also of the load surges on the FEAD (Front Engine Accessory Drive) component bearings and stretching serpentine belts.



The clutch mechanism in a starter drive, which is essentially what you find inside clutch pulleys, is designed to crank an engine for less than 5 seconds, then overrun freely for about another 5 seconds, then cool off for at least 20 seconds before the cycle re-starts. Even OE-catlicher drive clutches are only expected to withstand this cycle about 50,000 times before failing.

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Yet an alternator clutch pulley locks and releases 3 times per engine revolution at idle, or about 144,000 times per hour...with no rest period. When you compare these simple numbers, it becomes painfully obvious why clutch pulleys don't last.

We Offer the Benefits of a Decoupler, with Far Greater Reliability

CT DRIVES



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Products	

## Comparison of Belt Tensioner Calming Effect by Alternator Pulley Type

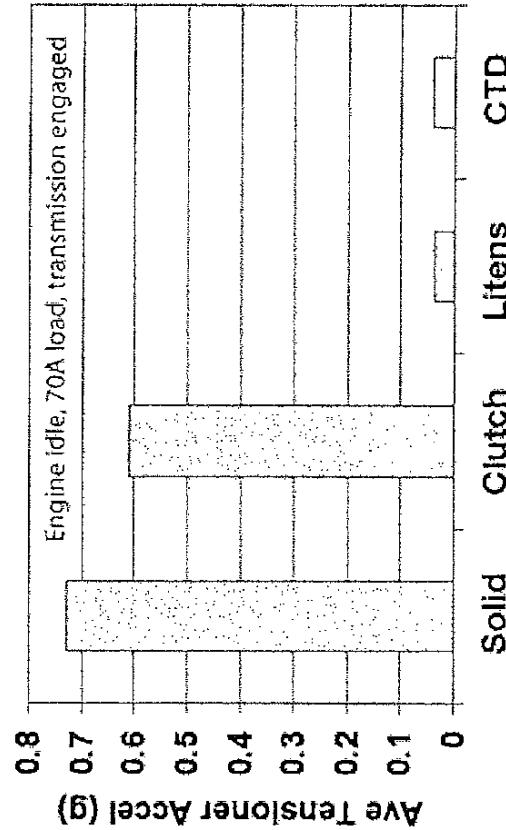


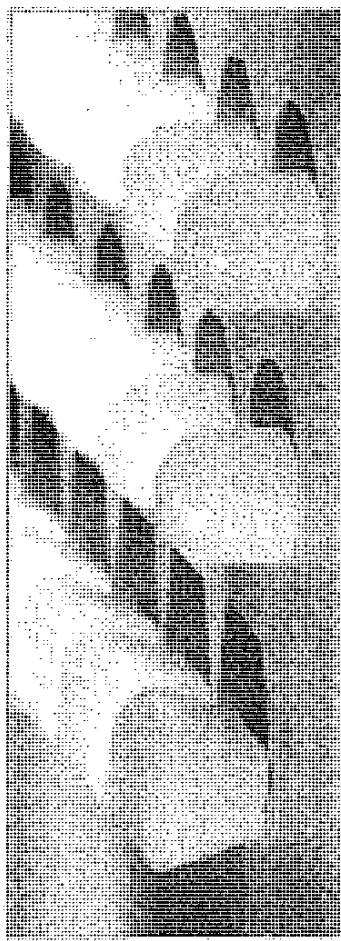
Figure 1- Data shows that CTD and Litens IDP pulleys offer equivalent tensioner calming effects. Solid pulleys pass on all the engine pulsations to the tensioner, stressing the FEAD system. Clutch pulleys lock and release suddenly, hammering the tensioner much like a solid pulley.

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When they were introduced to the market, decoupler pulleys were a big step forward—they used a spring and friction-clutch mechanism to attenuate engine excitation frequencies. This system isolates the alternator from the drive belt and significantly reduces noise, vibration and wear.

In short, it was a good mouse trap, but we've made a better, more reliable one. It starts with our proprietary spring system.

## CT DRIVES



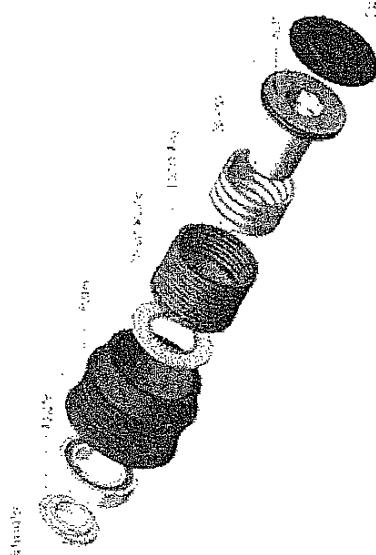
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Above: CT Drives springs are pulse-tuned for specific applications and engineered for extreme durability.

Conventional decouplers use a friction clutch and a steel coil spring, which have a tendency to fail from invisible fatigue cracks, corrosion, and heat stresses due to grease loss. We achieve the same belt and tensioner calming effects by using a simpler, proprietary and custom-formulated, high-temperature material spring. CT Drives springs never deform and can withstand continuous 130°C under hood temperatures with no lubrication and no loss in performance whatsoever.

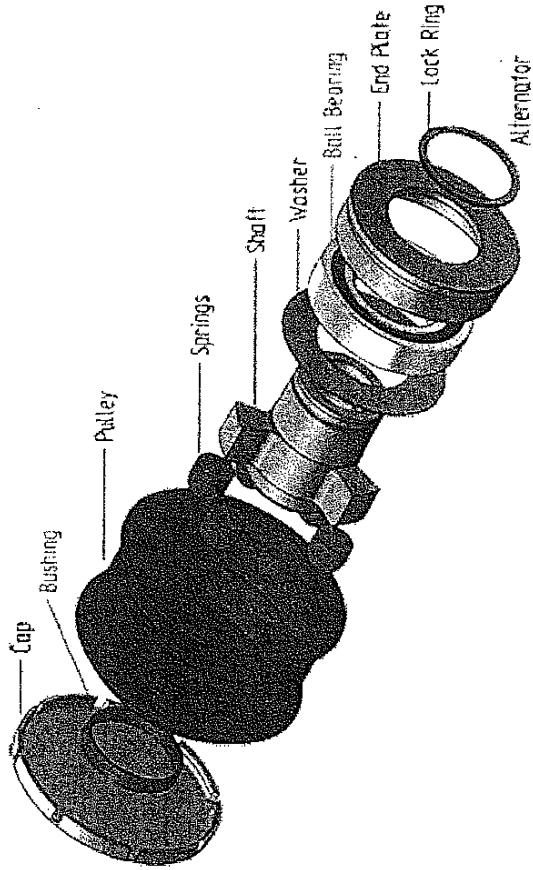
### Decoupler Pulley:



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CT Drives Pulley:



Simplicity is the key to CT Drives' durability.

The CT Drives springs and the alternator rotor comprise a spring - mass system which does have a resonant frequency. Yet, like decouplers, we designed our springs so that their resonant frequency is less than engine idle speed. So, in operation, the CT Drives pulley passes momentarily through resonance during the first partial revolution of the engine while it is being started, but never while the engine is running.

CT Drives is Incredibly Versatile

Like conventional decouplers, our springs are tuned for four, six and eight-cylinder applications and are, in a word, bullet proof.

Should the bearing in a CT Drives pulley actually fail, the pulley will still continue to transfer full torque so the alternator will charge the battery. No other product on the market can do the same. And when it comes time to eventually rebuild an alternator with a CT Drives pulley, servicing our pulley is as quick and simple as pressing out the end cap and replacing the springs. The CT Drives pulley is, hands-down, the easiest product of its kind to work with.

# CT DRIVES



Products

1. CT Drives Pulley  
2. CT Drives Decoupler  
3. CT Drives Alternator  
4. CT Drives Decoupling Pulley  
5. CT Drives Decoupling Alternator

The CT Drives design is so effective and flexible that it can also be incorporated into V-Belt pulleys. No other active pulley design can do this. Imagine, an effective solution to your customer's impossible to resolve V-Belt breakage issues... that is a simple drop-in fit into their current alternator!

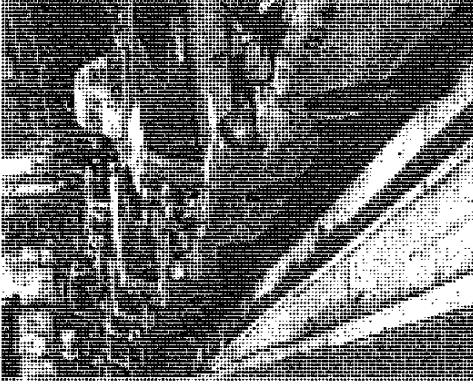


## CT DRIVES

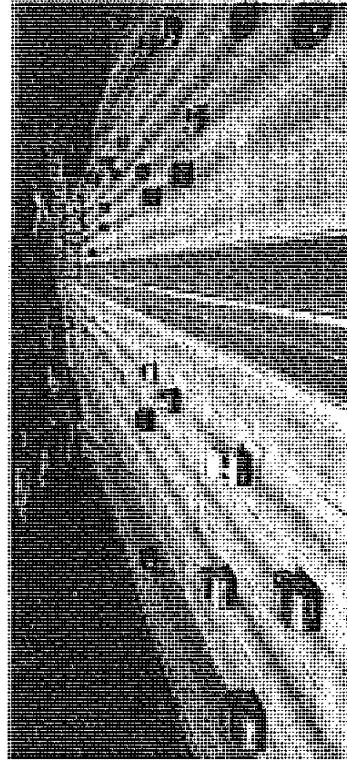


### CT Drives is Proven Under Brutal Conditions

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You couldn't dream up a more brutal testing ground. Constant stop and go traffic and pedal-to-metal gear shifts place extreme stress on drive belts and alternator pulleys. We've racked up over one hundred thousand miles under these conditions without a single failure.



[Download our printable product brochure.](#)

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[Company Overview](#)  
[Technology](#)  
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[Belt On/Off System](#)

[Pulley Comparison](#)

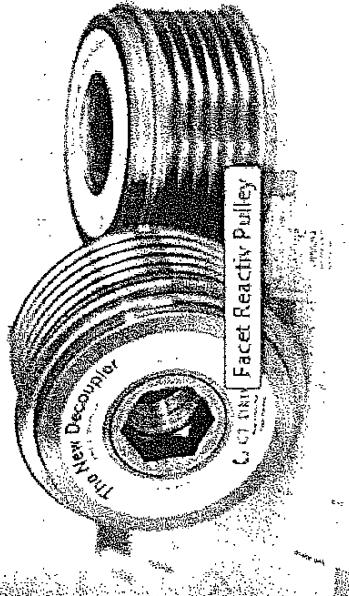
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The CT Drives Pulley is a patent pending system that provides the same benefits as both clutch and decoupler pulleys in a much simpler and more reliable design. What's more, the CT Drives Pulley is the only product on the market you can use as a direct swap and replacement for both clutch and decoupler pulleys!

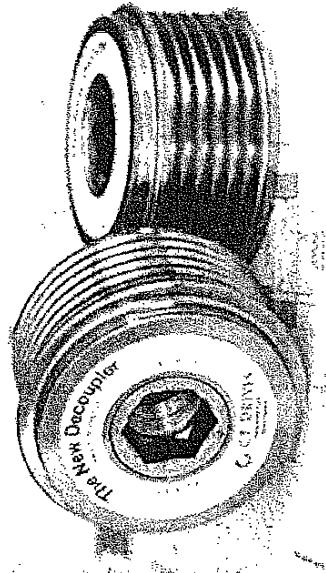
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# CT DRIVES



Company Overview	Technology	Product	Features & Benefits	Durability Field Tests
Company Overview	Technology	Product	Features & Benefits	Durability Field Tests



Facet Reactive Pulley

## Dynamics and Function of CTD Pulleys Evaluated During Taxi Fleet Trials

Cabs	Cumulative Miles To Date	Start-up Complaints	Belt Chirp Complaints	Pulley Failures
14	60,000 (ongoing)	None	None	None

ALL CABS ARE 2001 – 2006 CHRYSLER 3.3/3.8L ENGINES  
Lester 1387013871 Alternators

Figure 7- At 30 day intervals, CTD pulleys fitted to test taxis were bench tested and evaluated. All CTD pulleys maintained performance standards and had no failures.

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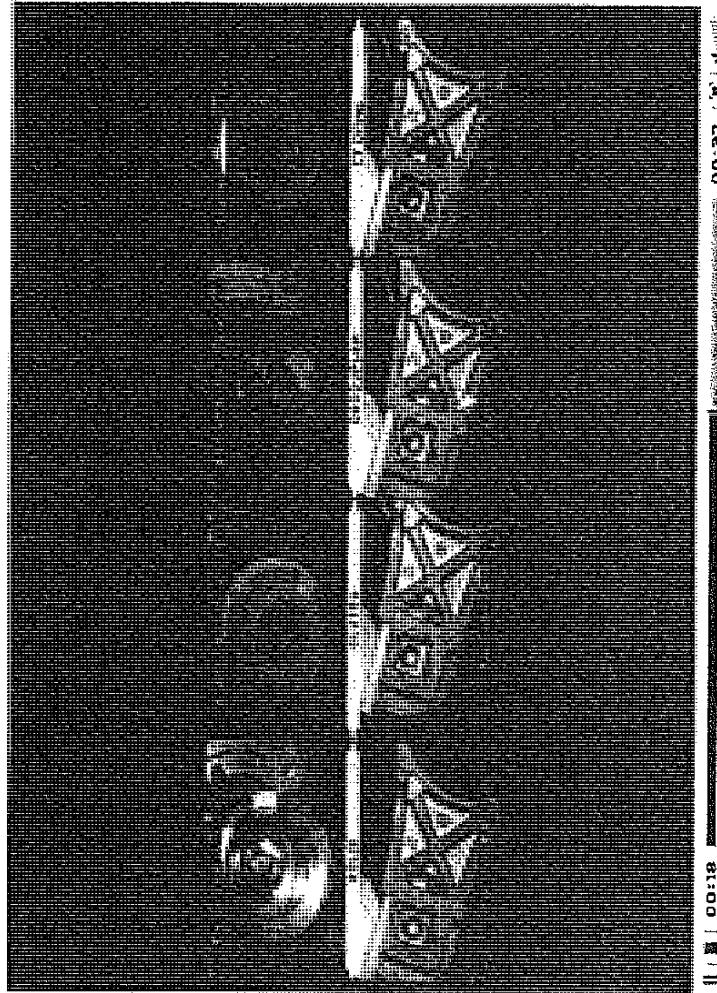
In this section we will post information that defines the features and or benefits of this unique and inexpensive solution for traditional decoupler pulleys.

Years	Miles To Date	Complaints	Complaints	Failures
14	60,000 (ongoing)	None	None	None

ALL CABS ARE 2001 - 2006 CHRYSLER 3.3/3.8L ENGINES  
Lester 13870/13871 Alternators

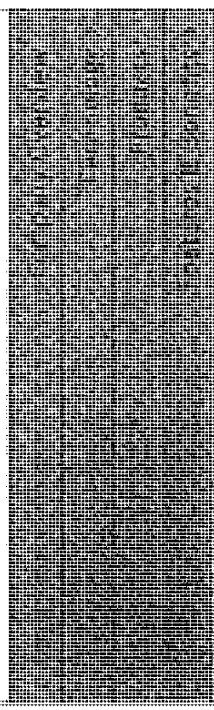
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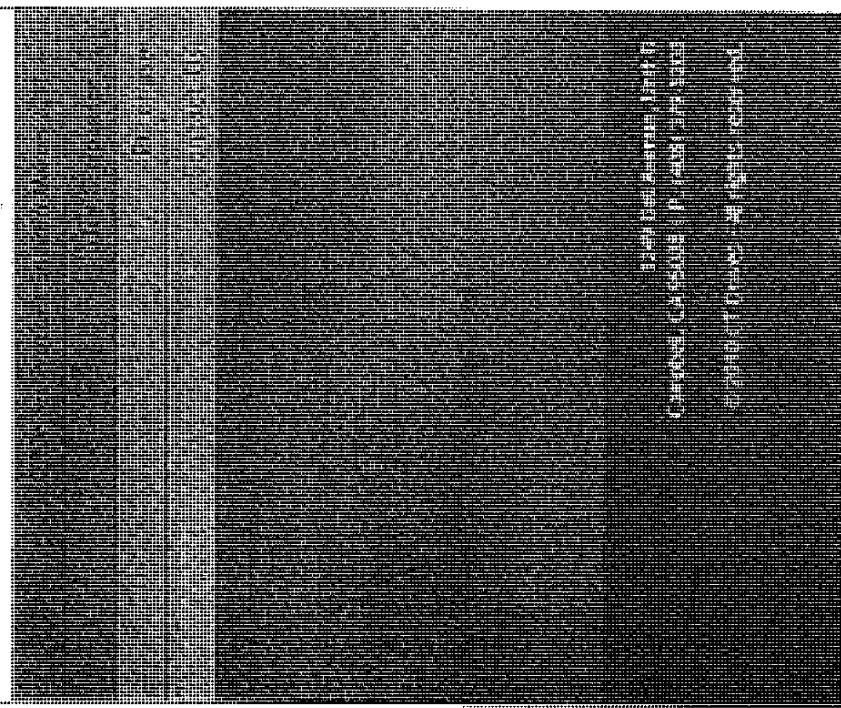


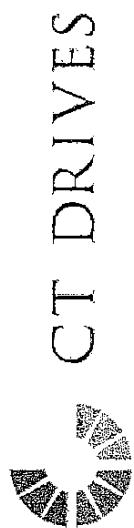
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## CT DRIVES



### Durability Field Trials





CT DRIVES

Company Overview  
Technology  
Products  
Partners  
Literature

Customer Support

CT Drives Product Bulletin March 2011

Testing Indicates CTD IDP Performance is Equivalent to  
Decoupler Pulleys and Superior to Clutch and Solid  
Pulleys in Isolating the Drive Belt from Engine Speed  
Fluctuations.

**Comparison of Belt Tensioner Calming Effect by  
Alternator Pulley Type**

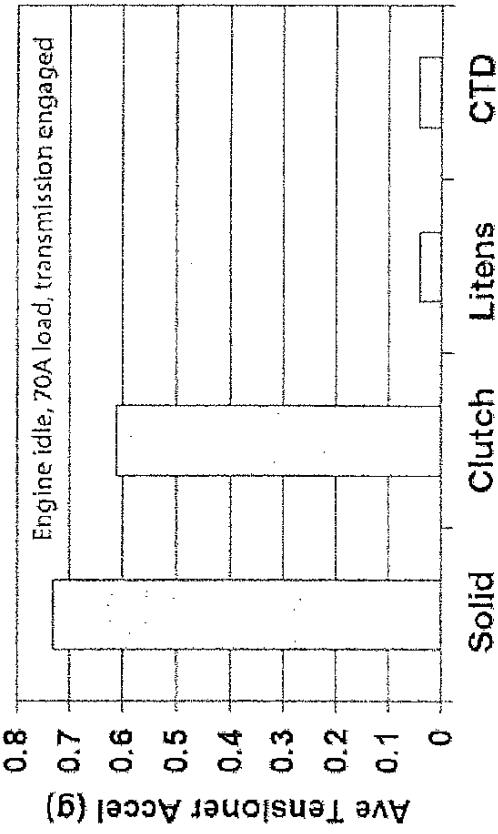


Figure 1- Data shows that CTD and Litens IDP pulleys offer equivalent tensioner  
calming effects. Solid pulleys pass on all the engine pulsations to the tensioner,  
stressing the FEAD system. Clutch pulleys lock and release suddenly, hammering  
the tensioner much like a solid pulley.

## Comparison of Tensioner Motion under Load by Pulley Type

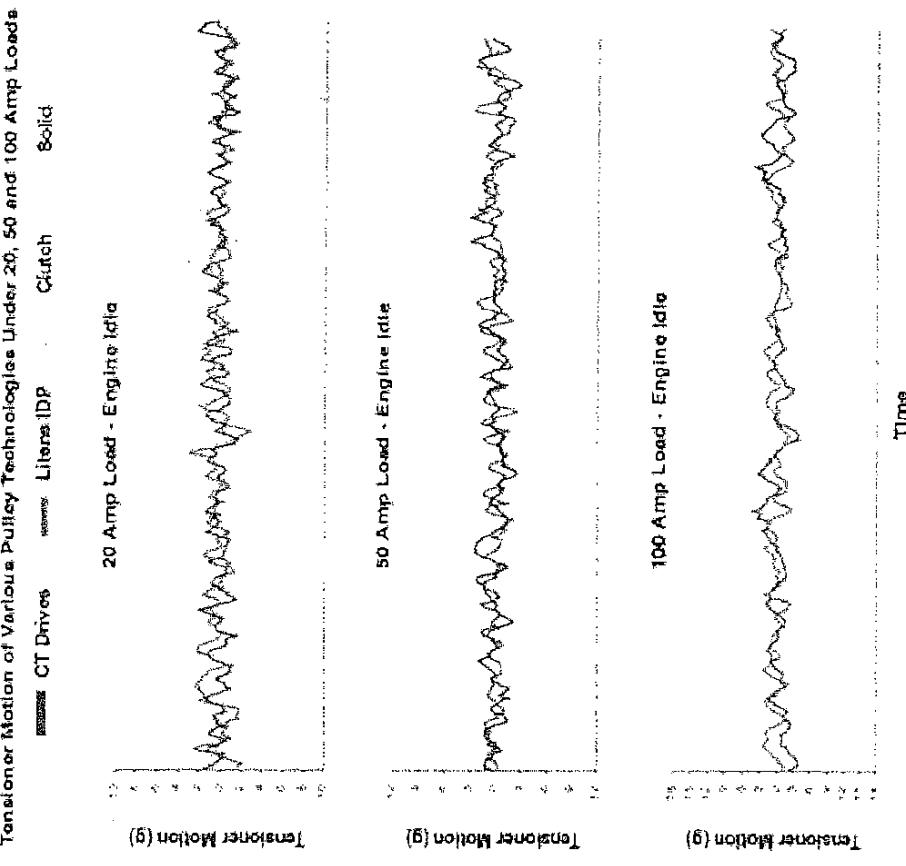


Figure 2- Data shows that CTD and Litens IDP pulleys are comparably effective in decoupling the rotor from the belt. Solid and clutch pulleys expose the tensioner and belt-path components to increasing vibration, belt stretching, and radial loads as the alternator output increases.

## CT DRIVES



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Technology  
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# CTD DRIVES



## Comparison of Engine Start Conditions by Pulley Type

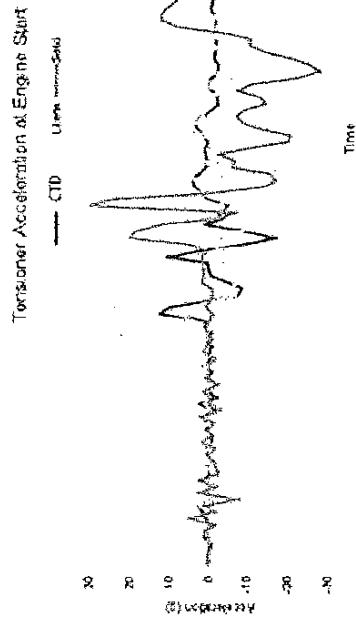


Figure 3- Pulley Type Comparison

Figure 3- Data shows that a solid pulley on this vehicle triggers large amplitude acceleration disturbances on the belt and tensioner during engine starts. Both CTD and Litens pulleys offer enough overrun to function equally in the amount belt calming effect they add during engine starts as well as during sudden engine speed changes.

## CTD and Litens Pulleys Functionally Equivalent

The data in figures 1-3 is from testing the dynamics of solid and IDP pulleys on 2003, 3.8L Chrysler van test engines with 160A alternators. This drivetrain was chosen since it's the most common application equipped with OEM decoupler pulleys.

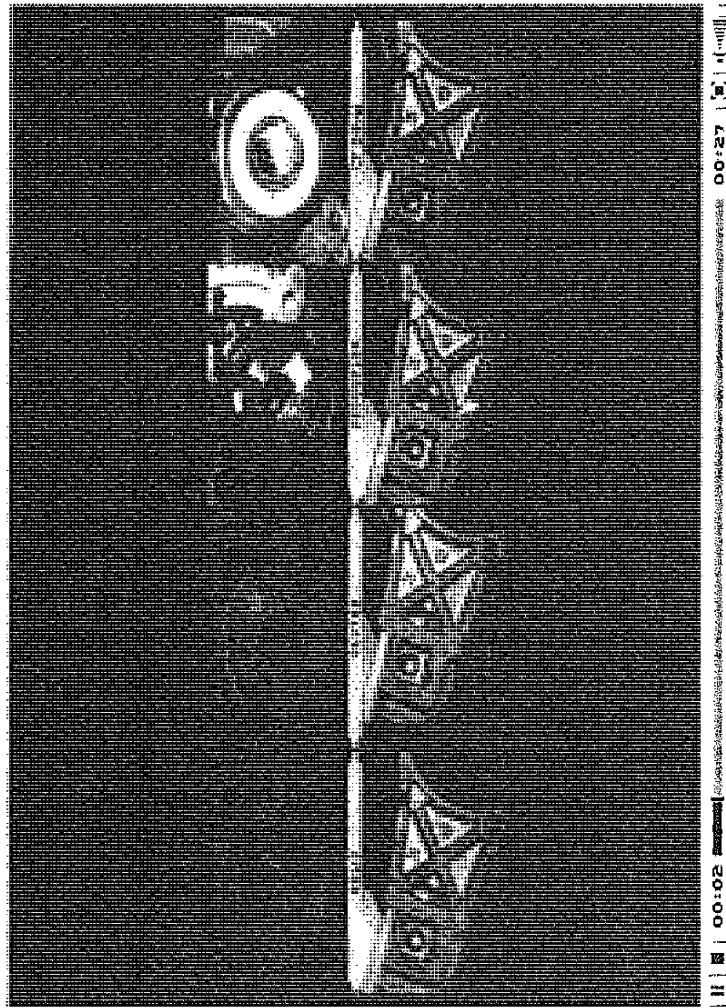
The data is consistent in showing that solid and clutch pulleys do not isolate the drive belt from engine speed pulsations as effectively as Litens and CTD IDP decoupler pulleys. In all tests, Litens and CTD decoupling technologies show functionally equivalent performance.

drive belt from engine speed pulsations as effectively as Litens and CTD IDP decoupler pulleys. In all tests, Litens and CTD decoupling technologies show functionally equivalent performance.

## CT DRIVES



### Pulley Comparison Video



The strobe effect freezes the pulley/rotor shaft and captures the spring responsive isolation of Litens and CTD IDP™ pulleys.

Note how the clutch pulley locks and overruns 3x per engine revolution, hammering the belt and causing tensioner vibrations.

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<a href="#">Technology</a>
<a href="#">Products</a>
<a href="#">Features &amp; Benefits</a>
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# CT DRIVES



## Ongoing Durability Evaluation and Monitoring of CTD IDP Pulleys Shows No Failures and No Degradation in Performance Over Time. Figure

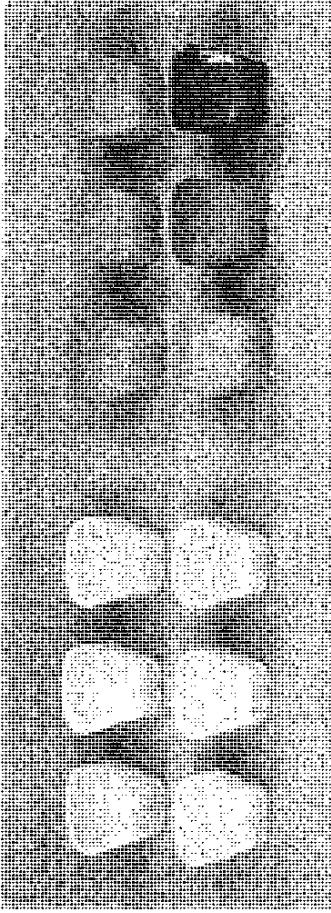


Figure 4- Internal springs from a CTD pulley used in service on a 2004 3.8L Chrysler van. This photo shows discoloration but no significant physical degradation of the six high-temperature and chemical-resistant polymer springs after 100,000 miles of service. For comparison, new polymer springs are shown on the left.

## Performance of CTD Pulley at 100,000 Miles Versus New Pulleys

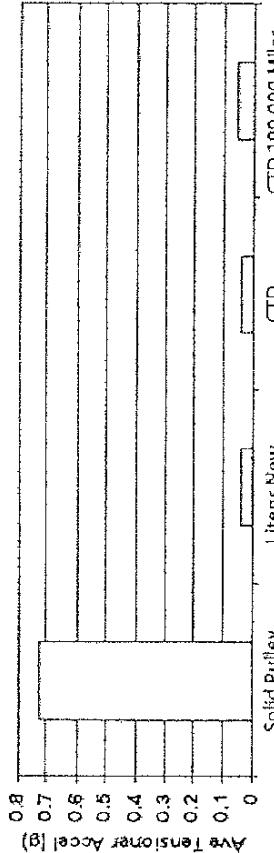


Figure 5- After 100,000 miles CTD pulleys showed no significant degradation in performance and remain functionally equivalent to both new Litens IDP and CTD IDP pulleys.

## Performance of CTD Pulley- 100,000 Miles Versus New

## CT DRIVES

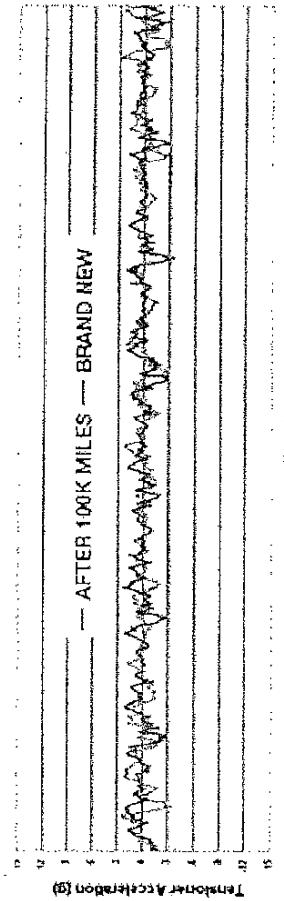


Figure 6- After 100,000 miles CTD pulleys showed no signi cant degradation in performance and remain functionally equivalent to a new pulleys.

## CT Drives Product Bulletin March 2011

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**Dynamics and Function of CTD Pulleys Evaluated During  
Taxi Fleet Trials**

Cabs	Cumulative Miles To Date	Start-up Complaints	Belt Chirp Complaints	Pulley Failures
14	60,000 (ongoing)	None	None	None

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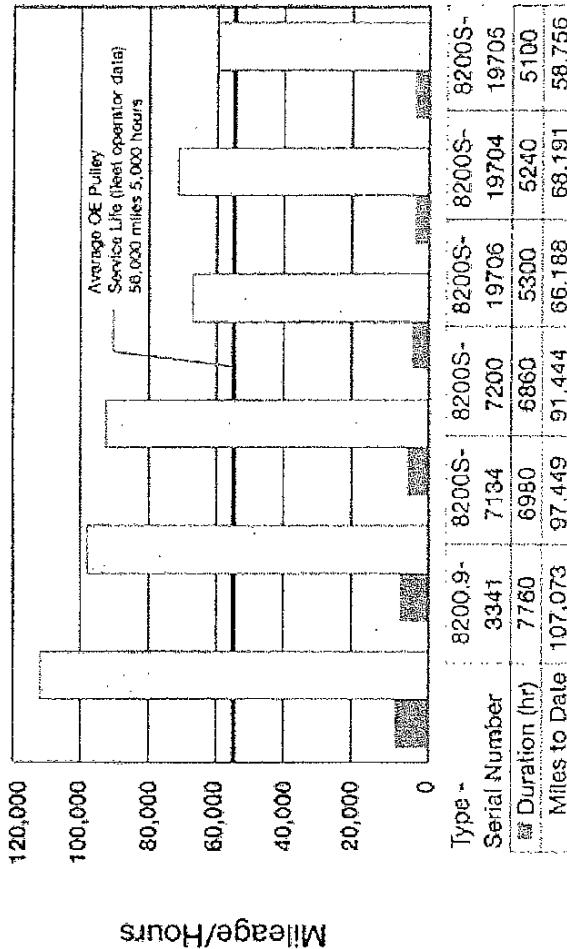
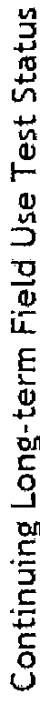
Figure 7- At 30 day intervals, CTD pulleys tied to test taxis were bench tested and evaluated. All CTD pulleys maintained performance standards and had no failures.

CT DRIVES



Figure 7. At 30 day intervals, CTD pulleys tested to test taxis were bench tested and evaluated. All CTD pulleys maintained performance standards and had no failures.

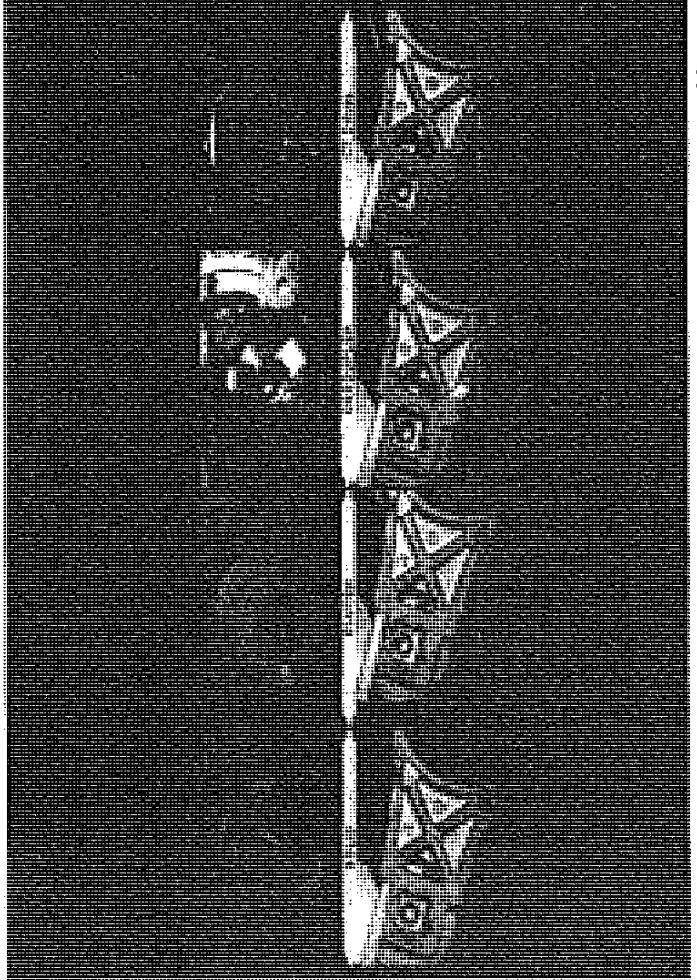
Company Overview	Technology	Products	Features & Benefits	Our Clientele
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Company Overview	Technology	Products	Features & Benefits	Our Clientele
Company Overview	Technology	Products	Features & Benefits	Our Clientele
Company Overview	Technology	Products	Features & Benefits	Our Clientele



Mileage as of February 2011 for the six highest mileage pulleys of the fourteen pulleys currently in use (all fourteen pulleys have accumulated over 30,000 miles thus far with no performance degradation). The mean time between failures (MTBF) for the OE pulley under similar field use test conditions is estimated to be 56,000 miles.

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Facet Reactive Pulley

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Features & Benefits

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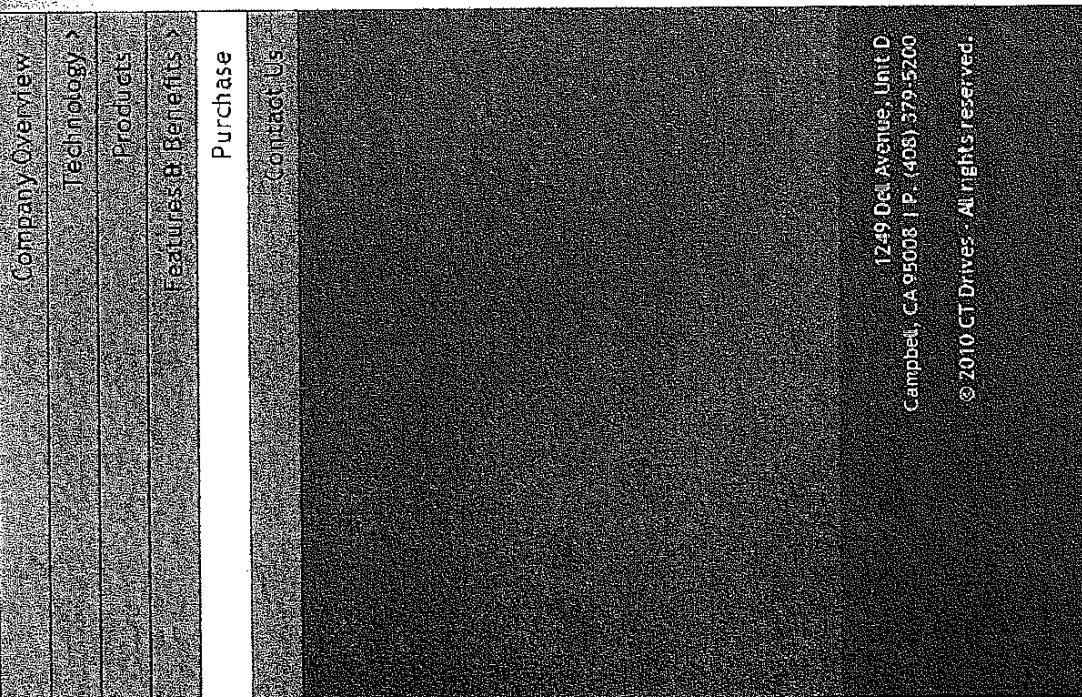
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What color is the sky?

*(This question is here for your own safety.)*

Our Offices and Product Development Facilities are located at

GT Drives

1249 Dell Avenue, Unit D, Campbell, CA 95008

Phone: (408) 379-5200

Fax: (408) 376-3570

